



# National Voluntary Laboratory Accreditation Program



## CALIBRATION LABORATORIES

NVLAP LAB CODE 201017-0

### SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

<b>Transcat – Ann Arbor</b> <b>Terumo Cardiovascular</b> 6200 Jackson Road Ann Arbor, MI 48103 Mr. Mike Stachowicz Phone: 585-352-9720 Fax: 800-395-0543 E-mail: mike.stachowicz@transcat.com URL: www.transcat.com	<b>Parameter(s) of Accreditation</b> Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Thermodynamic  This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (20/A01)
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### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)<sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3</sup>	Remarks
<b>DIMENSIONAL</b>			
<b>LENGTH &amp; DIAMETER; STEP GAGES (20/D05)</b>			
Micrometers & Calipers – Outside, Inside, Depth	0 in to 0.05 in 0.05 in to 0.4 in 0.4 in to 1 in 1.0 in to 4.0 in 4.0 in to 21 in	8 $\mu$ in 6.5 $\mu$ in + 1 $\mu$ in/in 7.0 $\mu$ in + 2 $\mu$ in/in 4.0 $\mu$ in + 5 $\mu$ in/in 10 $\mu$ in + 4.0 $\mu$ in/in	Comparison to Gage Blocks
Anvil Flatness	0 in to 1 in	7.1 $\mu$ in	Optical Flats
Anvil Parallelism	0 in to 1 in	9.1 $\mu$ in	Optical Parallel
Digital & Dial Indicators	0 in to 1 in 1 in to 6 in	41 $\mu$ in + 0.5 $\mu$ in/in 37 $\mu$ in + 3.0 $\mu$ in/in	Comparison to Gage Blocks
Test Indicators	0 in to 0.025 in	5.6 $\mu$ in	P & W Labmaster
Single Axis – Outside, Inside	0 in to 1 in 1 in to 3 in 3 in to 6 in	5.0 $\mu$ in + 1.5 $\mu$ in/in 4.0 $\mu$ in + 3.5 $\mu$ in/in 4.0 $\mu$ in + 4.0 $\mu$ in/in	P & W Labmaster
<b>MEASURING WIRES (20/D07)</b>			
Thread Wire Sets	2 TPI to 120 TPI	10 $\mu$ in	P & W Labmaster

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*Effective dates*

*Wm R. McQ*  
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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3</small>	Remarks
<b>SPHERICAL DIAMETER; PLUG/RING GAGES (20/D11)</b>			
Diameter - Outside	0 in to 1 in 1 in to 3 in 3 in to 6 in	8 $\mu$ in + 1.0 $\mu$ in/in 7 $\mu$ in + 3.0 $\mu$ in/in 8 $\mu$ in + 3.0 $\mu$ in/in	P & W Labmaster
Diameter - Inside	0.01 in to 0.20 in 0.20 in to 0.375 in 0.375 in to 6.0 in	6.5 $\mu$ in 8.5 $\mu$ in 8 $\mu$ in + 3.5 $\mu$ in/in	P & W Labmaster
<b>THREADED PLUGS &amp; RINGS (20/D14)</b>			
Plug – Outer Pitch Diameter	0 in to 3 in 3 in to 6 in	80 $\mu$ in 83 $\mu$ in	P&W Labmaster with thread wires
Plug – Major Diameter	0 in to 1 in 1 in to 3 in 3 in to 6 in	8 $\mu$ in + 1.0 $\mu$ in/in 7 $\mu$ in + 3.0 $\mu$ in/in 8 $\mu$ in + 3.0 $\mu$ in/in	P & W Labmaster
Ring – Inner Pitch Diameter	0 in to 3 in	80 $\mu$ in	Master Plug Gages
Ring – Minor Diameter	0.010 in to 0.275 in 0.275 in to 0.800 in 0.800 in to 0.825 in 0.825 in to 1.510 in 1.510 in to 2.000 in	48 $\mu$ in 150 $\mu$ in 48 $\mu$ in 71 $\mu$ in 94 $\mu$ in	Class X Pins Bore Gage Tri-lock Class X Tri-lock Class X Tri-lock Class X

### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>ELECTROMAGNETICS – DC/LOW FREQUENCY</b>				
<b>AC RESISTORS AND CURRENT (20/E02)</b>				
AC Current – Measuring Equipment Field calibrations available <small>Note 4</small>	29 $\mu$ A to 330 $\mu$ A	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz	0.16 % + 0.08 $\mu$ A 0.12 % + 0.08 $\mu$ A 0.097 % + 0.08 $\mu$ A 0.23 % + 0.12 $\mu$ A	Fluke 5520A

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
		5 kHz to 10 kHz 10 kHz to 30 kHz	0.62 % + 0.16 $\mu$ A 1.2 % + 0.31 $\mu$ A	
	0.33 mA to 3.3 mA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.16 % + 0.12 $\mu$ A 0.097 % + 0.12 $\mu$ A 0.078 % + 0.12 $\mu$ A 0.16 % + 0.16 $\mu$ A 0.39 % + 0.23 $\mu$ A 0.78 % + 0.47 $\mu$ A	
	3.3 mA to 33 mA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.14 % + 1.6 $\mu$ A 0.071 % + 1.6 $\mu$ A 0.035 % + 1.6 $\mu$ A 0.064 % + 1.6 $\mu$ A 0.16 % + 2.3 $\mu$ A 0.31 % + 3.1 $\mu$ A	
	33 mA to 330 mA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 30 kHz	0.14 % + 16 $\mu$ A 0.071 % + 16 $\mu$ A 0.033 % + 16 $\mu$ A 0.078 % + 39 $\mu$ A 0.16 % + 78 $\mu$ A 0.31 % + 0.16 mA	
	0.33 A to 1.0 A	10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.14 % + 78 $\mu$ A 0.040 % + 78 $\mu$ A 0.47 % + 0.78 mA 1.9 % + 3.9 mA	
	1.0 A to 3.0 A	10 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.14% + 78 $\mu$ A 0.049 % + 78 $\mu$ A 0.47 % + 0.78 mA 1.9 % + 3.9 mA	
	3.0 A to 11 A	45 Hz to 100 Hz 100 Hz to 1 kHz	0.048 % + 1.6 mA 0.079 % + 1.6 mA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
Clamp-on Ammeter Field calibrations available <small>Note 4</small>	11 A to 20.5 A	1 kHz to 5 kHz	2.3 % + 1.6 mA	
		45 Hz to 100 Hz	0.097 % + 3.9 mA	
		0.1 kHz to 1 kHz	0.12 % + 3.9 mA	
	3 A to 30 A 3 A to 30 A 30 A to 100 A 30 A to 100 A 100 A to 200 A 100 A to 200 A	1 kHz to 5 kHz	2.3 % + 3.9 mA	
		10 Hz to 100 Hz	0.24 % + 0.78 mA	Fluke 5520A with 9100-200 X10 Coil
		100 Hz to 440 Hz	0.56 % + 0.78 mA	
		45 Hz to 100 Hz	0.35 % + 16 mA	
		100 Hz to 440 Hz	0.56 % + 16 mA	
		10 Hz to 100 Hz	0.39 % + 39 mA	
AC Current – Measure Field calibrations available <small>Note 4</small>	100 A to 200 A 15 A to 150 A 15 A to 150 A 150 A to 500 A	100 Hz to 440 Hz	0.61 % + 39 mA	
		10 Hz to 45 Hz	0.39 % + 3.9 mA	Fluke 5520A with 9100-200 X50 Coil
		45 Hz to 100 Hz	0.39 % + 3.9 mA	
		45 Hz to 100 Hz	0.39 % + 80 mA	
	0 μA to 100 μA 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA	10 Hz to 100 Hz	0.39 % + 200 mA	
		10 Hz to 20 Hz	0.46 % + 35 nA	Agilent 3458A opt 2
		20 Hz to 45 Hz	0.18 % + 35 nA	
		45 Hz to 100 Hz	0.072 % + 35 nA	
		100 Hz to 5 kHz	0.072 % + 35 nA	
		10 Hz to 20 Hz	0.46 % + 0.23 μA	
AC Current – Measure Field calibrations available <small>Note 4</small>	100 μA to 1 mA 1 mA to 10 mA	20 Hz to 45 Hz	0.17 % + 0.23 μA	
		45 Hz to 100 Hz	0.071 % + 0.23 μA	
		100 Hz to 5 kHz	0.038 % + 0.23 μA	
		10 Hz to 20 Hz	0.46 % + 2.3 μA	
	1 mA to 10 mA 10 mA to 100 mA	20 Hz to 45 Hz	0.17 % + 2.3 μA	
		45 Hz to 100 Hz	0.071 % + 2.3 μA	
		100 Hz to 5 kHz	0.038 % + 2.3 μA	
		10 Hz to 20 Hz	0.46 % + 23 μA	
		20 Hz to 45 Hz	0.17 % + 23 μA	
		45 Hz to 100 Hz	0.070 % + 23 μA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
	100 mA to 1 A 1 A to 3A	100 Hz to 5 kHz 10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 3 Hz to 5 kHz	0.037 % + 23 $\mu$ A 0.46 % + 0.23 mA 0.19 % + 0.23 mA 0.097 % + 0.23 mA 0.12 % + 0.23 mA 0.18 % + 2.1mA	Agilent 34410A

### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>DC RESISTANCE AND CURRENT (20/E05)</b>			
DC Resistance – Measuring Equipment and Measure Field calibrations available <small>Note 4</small>	0 $\Omega$ to 10 $\Omega$ 10 $\Omega$ to 100 $\Omega$ 100 $\Omega$ to 1 k $\Omega$ 1 k $\Omega$ to 10 k $\Omega$ 10 k $\Omega$ to 100 k $\Omega$ 100 k $\Omega$ to 1 M $\Omega$ 1 M $\Omega$ to 10 M $\Omega$ 10 M $\Omega$ to 100 M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$	18 $\mu\Omega/\Omega$ + 58 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.58 m $\Omega$ 12 $\mu\Omega/\Omega$ + 0.58 m $\Omega$ 12 $\mu\Omega/\Omega$ + 5.8 m $\Omega$ 12 $\mu\Omega/\Omega$ + 58 m $\Omega$ 19 $\mu\Omega/\Omega$ + 2.3 $\Omega$ 62 $\mu\Omega/\Omega$ + 0.12 k $\Omega$ 0.059 % + 1.2 k $\Omega$ 0.58 % + 12 k $\Omega$	Agilent 3458A with Decade Resistor
DC Resistance – Measuring Equipment Field calibrations available <small>Note 4</small>	1 m $\Omega$ 2 m $\Omega$ 1 m $\Omega$ to 1 $\Omega$ 1 $\Omega$ to 10 $\Omega$ 10 $\Omega$ to 100 $\Omega$ 100 $\Omega$ to 1 k $\Omega$ 1 k $\Omega$ to 100 k $\Omega$ 100 k $\Omega$ to 10 M $\Omega$ 10 M $\Omega$ to 100 M $\Omega$ 100 M $\Omega$ to 1 G $\Omega$ 1 G $\Omega$ to 10 G $\Omega$ 10 G $\Omega$ to 1 T $\Omega$	0.29 % 0.29 % 2.3 m $\Omega$ 3.9m $\Omega$ 0.03 % 0.023 % 1.2 % 0.035 % 0.12 % 0.23 % 0.58 % 1.2 %	Empro Shunt Empro Shunt Decade Box

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
DC Current – Measuring Equipment Field calibrations available <small>Note 4</small>	0 mA to 330 $\mu$ A 0.33 mA to 3.3 mA 3.3 mA to 33 mA 33 mA to 330 mA 0.33 A to 1.1 A 1.1 A to 3.0 A 3.0 A to 11 A 11 A to 20.5 A	120 $\mu$ A/A + 0.02 $\mu$ A 82 $\mu$ A/A + 0.05 $\mu$ A 98 $\mu$ A/A + 0.19 $\mu$ A 78 $\mu$ A/A + 1.9 $\mu$ A 160 $\mu$ A/A + 31 $\mu$ A 300 $\mu$ A/A + 31 $\mu$ A 510 $\mu$ A/A + 0.39 mA 840 $\mu$ A/A + 0.58 mA	Fluke 5520A
DC Current – Measure Field calibrations available <small>Note 4</small>	0 to 100 $\mu$ A 0.1 mA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 0.1 A to 1 A  1 A to 3 A 3 A to 50 A	26 $\mu$ A/A + 0.9 nA 26 $\mu$ A/A + 5.8 nA 26 $\mu$ A/A + 58 nA 43 $\mu$ A/A + 0.58 $\mu$ A 0.013 % + 12 $\mu$ A  0.17 % + 0.69 mA 0.29 % + 1.5 mA	Agilent 3458A Opt 002  Agilent 34410A  Agilent 3458A with Empro Shunt
Clamp-on Ammeter Field calibrations available <small>Note 4</small>	3.3 A to 10 A 10 A to 30 A 30 A to 100 A 100 A to 200 A  16.5 A to 50 A 50 A to 150 A 150 A to 500 A 500 A to 1000 A	0.24 % + 0.31 mA 0.24 % + 0.31 mA 0.24 % + 3.9 mA 0.24 % + 5.8 mA  0.24 % + 0.16 mA 0.24 % + 0.16 mA 0.24 % + 20 mA 0.24 % + 29 mA	Fluke 5520A w/ 9100-200 X10 Coil  Fluke 5520A w/ 9100-200 X50 Coil
DC VOLTAGE (20/E06)			
DC Voltage –Measure Field calibrations available <small>Note 4</small>	0 mV to 100 mV 0.1 V to 1 V 1 V to 10 V 10 V to 100 V 100 V to 500 V	7.1 $\mu$ V/V + 0.58 $\mu$ V 5.0 $\mu$ V/V + 0.58 $\mu$ V 5.1 $\mu$ V/V + 0.58 $\mu$ V 7.6 $\mu$ V/V + 35 $\mu$ V 11 $\mu$ V/V + 0.12 mV	Agilent 3458A Opt 002

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
DC Voltage – Measuring Equipment Field calibrations available <small>Note 4</small>	500 V to 800 V	16 $\mu$ V/V + 0.12 mV	
	800 V to 1 kV	21 $\mu$ V/V + 0.12 mV	
	1 kV to 2 kV	0.047 % + 0.56 V	Vitrek 4620B
	2 kV to 20 kV	0.047 % + 33 V	
	0 mV to 330 mV	16 $\mu$ V/V + 0.78 $\mu$ V	Fluke 5520A
	0.33 V to 3.3 V	9.1 $\mu$ V/V + 1.6 $\mu$ V	
	3.3 V to 33 V	10 $\mu$ V/V + 16 $\mu$ V	
	33 V to 330 V	15 $\mu$ V/V + 0.12 mV	
	330 V to 1000 V	15 $\mu$ V/V + 1.2 mV	

### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>LF AC VOLTAGE (20/E09)</b>				
AC Voltage – Measure	0 mV to 10 mV	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 4 MHz	0.039 % + 3.5 $\mu$ V 0.028 % + 1.2 $\mu$ V 0.038 % + 1.2 $\mu$ V 0.15 % + 1.2 $\mu$ V 0.59 % + 1.2 $\mu$ V 4.6 % + 2.3 $\mu$ V 1.5 % + 5.8 $\mu$ V 8.1 % + 8.1 $\mu$ V	Agilent 3458A opt 002
	10 mV to 100 mV	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz 2 MHz to 4 MHz 4 MHz to 8 MHz	0.013 % + 4.6 $\mu$ V 0.0094 % + 2.3 $\mu$ V 0.017 % + 2.3 $\mu$ V 0.037 % + 2.3 $\mu$ V 0.093 % + 2.3 $\mu$ V 0.36 % + 12 $\mu$ V 1.2 % + 12 $\mu$ V 1.9 % + 12 $\mu$ V 4.7 % + 81 $\mu$ V 4.7 % + 92 $\mu$ V	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
	100 mV to 1 V	8 MHz to 10 MHz 1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz 2 MHz to 4 MHz 4 MHz to 8 MHz 8 MHz to 10 MHz	17 % + 0.12 mV 0.0098 % + 46 µV 0.0094 % + 23 µV 0.017 % + 23 µV 0.036 % + 23 µV 0.093 % + 23 µV 0.35 % + 0.12 mV 1.2 % + 0.12 mV 1.9 % + 0.12 mV 4.7 % + 0.81 mV 4.7 % + 0.93 mV 17 % + 1.2 mV	
	1 V to 10 V	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz 2 MHz to 4 MHz 4 MHz to 8 MHz 8 MHz to 10 MHz	0.0095 % + 0.46 mV 0.0095 % + 0.23 mV 0.017 % + 0.23 mV 0.036 % + 0.23 mV 0.093 % + 0.23 mV 0.35 % + 1.2 mV 1.2 % + 1.2 mV 1.9 % + 1.2 mV 4.7 % + 8.1 mV 4.7 % + 9.2 mV 17 % + 12 mV	
	10 V to 100 V	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.024 % + 4.6 mV 0.024 % + 2.3 mV 0.024 % + 2.3 mV 0.041 % + 2.3 mV 0.14 % + 2.3 mV 0.46 % + 12 mV 1.7 % + 12 mV	
	100 V to 700 V	1 Hz to 40 Hz 40 Hz to 1 kHz	0.047 % + 46 mV 0.047 % + 23 mV	

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AC Voltage – Measuring Equipment Field calibrations available <small>Note 4</small>	1.0 mV to 33 mV	1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz  700 V to 2 kV 700 V to 2 kV 2 kV to 20 kV  33 mV to 330 mV  330 mV to 3.3 V  3.3 V to 33 V	0.071 % + 23 mV 0.14 % + 23 mV 0.35 % + 23 mV  0.098 % + 2.4 V 0.47 % + 4.7 V 0.23 % + 60 V  0.01 Hz to 10 Hz 10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz  0.01 Hz to 10 Hz 10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz  10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 500 kHz  10 Hz to 45 Hz 45 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	Fluke 5520A Fluke 5520A Fluke 5520A Fluke 5520A

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
	33 V to 330 V	45 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.015 % + 1.6 mV 0.016 % + 4.7 mV 0.020 % + 4.7 mV 0.025 % + 4.7 mV 0.16 % + 39 mV	Fluke 5520A
<b>LF CAPACITANCE (20/E10)</b>				
Capacitance – Measuring Equipment Field calibrations available <small>Note 4</small>	0.19 nF to 1.1 nF 1.1 nF to 3.3 nF 3.3 nF to 11 nF 11 nF to 33 nF 33 nF to 110 nF 110 nF to 330 nF 330 nF to 1.1 $\mu$ F 1.1 $\mu$ F to 3.3 $\mu$ F 3.3 $\mu$ F to 11 $\mu$ F 11 $\mu$ F to 33 $\mu$ F 33 $\mu$ F to 110 $\mu$ F 110 $\mu$ F to 330 $\mu$ F 330 $\mu$ F mF to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to 11 mF 11 mF to 33 mF 33 mF to 110 mF	10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 600 Hz 10 Hz to 300 Hz 10 Hz to 150 Hz 10 Hz to 120 Hz 10 Hz to 80 Hz DC to 50 Hz DC to 20 Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz	0.39 % + 6.1 pF 0.39 % + 6.1 pF 0.21 % + 6.1 pF 0.21 % + 61 pF 0.21 % + 61 pF 0.21 % + 0.18 nF 0.20 % + 0.61 nF 0.20 % + 1.9 nF 0.20 % + 6.1 nF 0.32 % + 18 nF 0.35 % + 61 nF 0.35 % + 0.18 $\mu$ F 0.35 % + 0.61 $\mu$ F 0.35 % + 1.8 $\mu$ F 0.35 % + 6.1 $\mu$ F 0.58 % + 18 $\mu$ F 0.85 % + 61 $\mu$ F	Fluke 5520A
<b>OSCILLOSCOPES (20/E20)</b>				
Sine Wave Flatness	0.1 V to 3 V	50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz	2.1% + 0.12 mV 2.6% + 0.12 mV 4.8% + 0.12 mV	Fluke 5520A/6

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<b>TIME AND FREQUENCY</b>			
<b>FREQUENCY DISSEMINATION (20/F01)</b>			
Frequency – Measuring Equipment and Measure <sup>Note 9</sup>	10 MHz	$5.8 \times 10^{-10}$ Hz/Hz	Rubidium Oscillator
<b>PULSE WAVEFORM (20/F04)</b>			
Rise time - Generate	$\geq 350$ ps	11 ps	Fluke 5520A
Rise Time – Measure	$\geq 1.75$ ns	0.18 % + 1.8 ns	Agilent DSO-X 2022A
<b>MECHANICAL</b>			
<b>FORCE (20/M06)</b>			
Force Measuring Equipment	0.5 lbf to 200 lbf	0.025 %	NIST Class F Weights
<b>SPEED INDICATORS (20/M14)</b>			
Rotational Speed, Non-Contact, Laser Field calibrations available <sup>Note 4</sup>	6 rpm to 8000 rpm 8000 rpm to 25 000 rpm 25 000 rpm to 75 000 rpm 75 000 rpm to 100 000 rpm	0.025% 0.008 % 0.0075% 0.0072%	Shimpo DT-207L
Rotational Speed, Non-Contact, Strobe Field calibrations available <sup>Note 4</sup>	100 FPM to 30 000 FPM (FPM is flashes per minute)	0.01%	Shimpo DT-315A
Rotational Speed, Contact Field calibrations available <sup>Note 4</sup>	0.10 rpm to 100 rpm 1000 rpm to 10 000 rpm 10 000 rpm to 25 000 rpm	0.09% 0.009% 0.020%	Shimpo DT-107A
Linear Speed, Contact <sup>Note 4</sup> Field calibrations available <sup>Note 4</sup>	0.05 ft/m to 1 k ft/m 1 k ft/m to 5 k ft/m	0.35 % 0.34 %	Shimpo DT-107A w/ Master 6" Wheel
<b>TORQUE (20/M15)</b>			
Torque – Measure Field calibrations available <sup>Note 4</sup>	5 lbf-in to 600 lbf-ft	0.5 %	CDI Torque Calibrator

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Torque Screwdrivers	1 lbf-in to 10 lbf-in	2.2 %	
	3 ozf-in to 80 ozf-in	2.2 %	
Torque – Measuring Equipment	0.5 N-cm	0.20 %	
Field calibrations available <sup>Note 4</sup>	1 N-cm	0.17 %	200 mm Arm and Weights
	10 N-cm	0.17 %	
	10 lbf-in to 125 lbf-in	0.19 %	10 in & 15" Arm and Weights

### WEIGHING INSTRUMENTS (20/M16)

Mass – Measuring Equipment Field calibrations available <sup>Note 4</sup>	10 kg	7.6 mg	Characterized ASTM Class 1 Mass Standards
	5 kg	3.9 mg	
	3 kg	5.1 mg	
	2 kg	1.4 mg	
	1 kg	0.81 mg	
	500 g	0.45 mg	
	300 g	0.29 mg	
	200 g	0.17 mg	
	100 g	96 µg	
	50 g	61 µg	
	30 g	25 µg	
	20 g	44 µg	
	10 g	52 µg	
	5 g	9 µg	
	3 g	10 µg	
	2 g	10 µg	
	1 g	8 µg	
	500 mg	8 µg	
	300 mg	8 µg	
	200 mg	8 µg	
	100 mg	8 µg	
	50 mg	8 µg	
	30 mg	8 µg	
	20 mg	8 µg	

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# National Voluntary Laboratory Accreditation Program



## CALIBRATION LABORATORIES

NVLAP LAB CODE 201017-0

### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)<sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
Avoirdupois	10 mg 5 mg 3 mg 2 mg 1 mg  50 lb 20 lb 10 lb 5 lb 2 lb 1 lb 0.5 lb	8 µg 8 µg 8 µg 8 µg 8 µg  0.0059 lb 0.0023 lb 0.0011 lb 0.00059 lb 0.00023 lb 0.00018 lb 0.00011 lb	NIST Class F Mass Standards
<b>THERMODYNAMIC</b>			
<b>HUMIDITY (20/T02)</b>			
Relative Humidity – Measure Field calibrations available <sup>Note 4</sup>	0 % RH to 90 % RH  90 % RH to 100 % RH	3.5 % RH 1.3 % RH 3.5 % RH  4.6 % RH 2.4 % RH 4.6 % RH	Vaisala HMI-41/HMP76
Temperature – Measure Field calibrations available <sup>Note 4</sup>	-195 °C to 0 °C 0 °C to 420 °C 420 °C to 660 °C	0.012 °C 0.025 °C 0.037 °C	SPRT
Temperature – Measuring Equipment Field calibrations available <sup>Note 4</sup>	-30 °C to 0 °C 0 °C to 200 °C	0.046 °C 0.081 °C	SPRT w/ Bath
<b>LABORATORY THERMOMETERS, DIGITAL AND ANALOG (20/T03)</b>			

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### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)<sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
<b>PRESSURE (20/T05)</b>			
Absolute Measure & Measuring Equipment Field calibrations available <sup>Note 4</sup>	0 to 35 psia 35 to 1000 psia	0.007 psi 0.02 % + 0.007 psi	DH PPC4EX (7M)
Gage Pressure Measure & Measuring Equipment – Pneumatic Field calibrations available <sup>Note 4</sup>	-14.7 psig to 35 psig 35 psig to 1000 psig	0.007 psi 0.02 %	DH PPC4EX (7M)
<b>TEMPERATURE INDICATORS (20/T08)</b>			
Electrical Calibration of Thermocouple Devices Field calibrations available <sup>Note 4</sup>			
Type J	-210 °C to 1200 °C	0.10 °C	Thermocouple Half Junctions
Type K	-270 °C to 1372 °C	0.10 °C	
Type T	-270 °C to 400 °C	0.10 °C	
Type E	-270 °C to 1000 °C	0.10 °C	
Type B	600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1550 °C 1550 °C to 1820 °C	0.34 °C 0.26 °C 0.23 °C 0.26 °C	Fluke 5520A
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.44 °C 0.27 °C 0.26 °C 0.31 °C	
Type S	0 °C to 250 °C 250 °C to 1000 °C 1000 °C to 1400 °C 1400 °C to 1767 °C	0.44 °C 0.28 °C 0.29 °C 0.36 °C	
Type N	-200 °C to -100 °C	0.31 °C	

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### CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)<sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
	-100 °C to -25 °C	0.17 °C	
	-25 °C to 120 °C	0.15 °C	
	120 °C to 410 °C	0.14 °C	
	410 °C to 1300 °C	0.21 °C	
<b>END</b>			

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## CALIBRATION LABORATORIES

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### Notes

**Note 1:** A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

**Note 2:** Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

**Note 3:** The uncertainty associated with a measurement in a CMC is an expanded uncertainty using a coverage factor,  $k = 2$ , with a level of confidence of approximately 95 %. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

**Note 3a:** The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

**Note 3b:** As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

**Note 3c:** As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions*. However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements.

**Note 4:** Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

**Note 5:** Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

**Note 6:** NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

**Note 7:** See [NIST Handbook 150](#) for further explanation of these notes.

**Note 8:** The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one, but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.

**Note 9:** Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise and gating errors.

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